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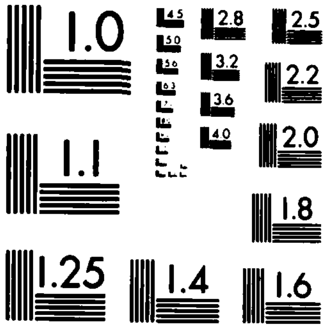

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AD-A157 927

Ways to Improve Construction Contract Modification Processing: USAFEA Korea Case Study

by
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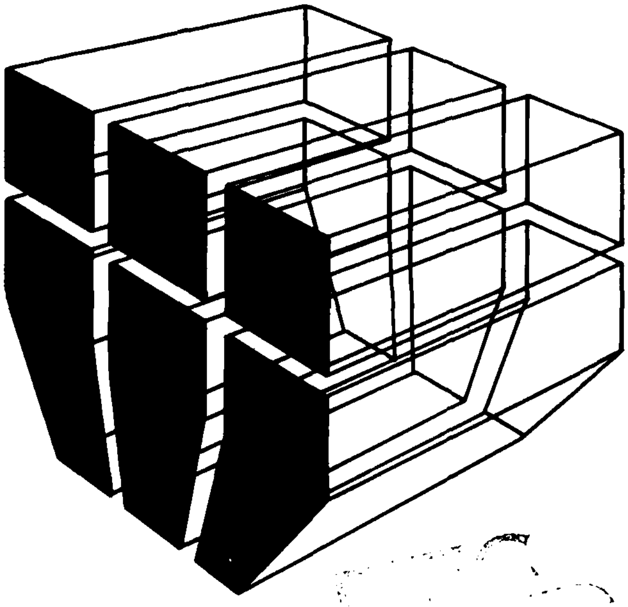
This report presents recommendations for improving the processing of construction contract modifications within Korea, principally within the U.S. Army Facilities Engineer Activity, Korea (EAFE or FEA-K). It also suggests ways to reduce the volume of modifications.

Nineteen recommendations are proposed, classed according to three categories: (1) avoiding modifications, (2) improving modification processing, and (3) enhancing workforce capabilities. Most of the recommendations are based on improving information quality, preparation, and transmission between FEA-K and the U.S. Army Engineer District, Far East. The first category is geared to enhancing initiatives already underway at FEA-K (destructive testing) and FED (AE followup on design review comments), and the publication of an Eighth United States Army (EUSA) policy paper on modification approval/processing. The second category offers recommendations for management control, establishing a Standard Operating Procedure (SOP), determining processing activity changes, using local materials, improving communication with FED, and providing funding flexibility. The last category suggests new initiatives for recruitment, automation, and communication changes to accommodate personal computers for HQ FEA-K decision support.



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This report presents recommendations for improving the processing of construction contract modifications within Korea, principally within the U.S. Army Facilities Engineer Activity, Korea (EAFE or FEA-K). It also suggests ways to reduce the volume of modifications.

During the past several years the military construction workload has grown from a small amount--$2.2 million in FY75--to a very large program--$57 million in FY84, with

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$150 million planned for FY85. Management difficulties have grown correspondingly as FEA-K, lacking many of the necessary tools, has wrestled with the increased number of projects. FEA-K's major constructor, the U.S. Army Engineer District, Far East (POF or FED) has been similarly overwhelmed. Together, they have had to seek more efficient ways of interorganizational coordination and modification processing, which is improving.

Earlier, participants involved in the Korean construction contract modification process managed that process for a small workload in a manner not readily adaptable to a growing, and now large, workload. Presently, there are 30 to 50 modification funds requests backlogged at FEA-K. If prior year funds must come from Headquarters, Department of the Army (HQDA), FED may wait as much as 142 days for notification of funds availability. Information sharing and documentation transmission must be rapid and well-organized, if gains in modification processing time are to be realized.

Nineteen recommendations are proposed, classed according to three categories: (1) avoiding modifications, (2) improving modification processing, and (3) enhancing workforce capabilities. Most of the recommendations are based on improving information quality, preparation, and transmission between FEA-K and the U.S. Army Engineer District, Far East.

The first category is geared to enhancing initiatives already underway at FEA-K (destructive testing) and FED (AE followup on design review comments), and the publication of an Eighth United States Army (EUSA) policy paper on modification approval/processing. The second category offers recommendations for management control, establishing a Standard Operating Procedure (SOP), determining processing activity changes, using local materials, improving communication with FED, and providing funding flexibility. The last category suggests new initiatives for recruitment, automation, and communication changes to accommodate personal computers for HQ FEA-K decision support.

FOREWORD

This investigation was performed for the Office of the Assistant Chief of Engineers (OACE), under the Operations and Maintenance, Army-funded project, "Responsiveness Analysis of Military Programs (RAMP)." The OACE Technical Monitor was Mr. John J. Sheehey, III.

This work was performed by the Facility Systems (FS) Division of the U.S. Army Construction Engineering Research Laboratory (USA-CERL). Mr. E. A. Lotz is Chief of USA-CERL-FS.

COL Paul J. Theuer is Commander and Director of USA-CERL, and Dr. L. R. Shaffer is Technical Director.

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WAYS TO IMPROVE CONSTRUCTION CONTRACT MODIFICATION PROCESSING: USAFEA KOREA CASE STUDY

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1 INTRODUCTION

Background

Delays in construction contract modification processing have hampered timely delivery of completed facilities to Eighth United States Army (EUSA) elements, prompting Army engineer offices in Korea to undertake actions to decrease modification processing time, in addition to reducing the amount of modifications themselves. Offices involved in the action include the EUSA Engineer (ENJ), the U.S. Army Facilities Engineer Activity, Korea (FEA-K), and the U.S. Army Engineer District, Far East (FED).

The U.S. Army Construction Engineering Research Laboratory (USA-CERL) was tasked to analyze this problem from the EUSA/FEA-K perspective. FED requested the Management Analysis Branch, U.S. Army Engineer Division, Pacific Ocean (PODDC-M) to analyze the problem from their perspective. Additionally, both groups were to analyze opportunities for improved FED-FEA-K modification processing interaction.

Objective and Scope

The objective of this report is to (1) identify potential ways to avoid modifying construction contracts and (2) when modifications are unavoidable, to identify methods to process them faster within FEA-K. Investigations were limited to those opportunities within FEA-K and those interface points between FEA-K and FED. FED internal processing of modifications is not addressed. The scope of the study was limited to EUSA Military Construction, Army (MCA) and Operations and Maintenance, Army (OMA) project modifications processing.

Approach

Information for this study was gathered from interviews with FEA-K and FED personnel, conducted primarily at their respective headquarters and at two field locations--Camp Casey (Tongduchon) and Camp Henry (Taegu). While in Korea, an initial analysis, conclusions, and tentative recommendations were made. The recommendations were presented to the FEA-K commander and his key staff. Their reactions and comments were considered and are reflected in this final report.

Organization of Report

Chapter 2 describes the Korean environment, in terms of facility deficiencies, FEA-K workforce problems, and external factors beyond FEA-K's control and how these issues impact modifications. Chapter 3 describes the construction contract modification process. Chapter 4 explains initiatives underway at FEA-K and FED to correct some of the modification problems being experienced in Korea. Finally, Chapter 5 contains USA-CERL's conclusions and recommendations.

2 THE KOREAN ENVIRONMENT

Facilities

The primitive EUSA living and working conditions throughout Korea are improving perceptibly. With an almost five-fold increase planned in the annual MCA program (mostly replacement projects) by 1991, a soldier's tour in Korea during the '90s will be much better than tours of duty during the '60s and '70s and will near comparability with Army standards. Figure 1 shows the planned MCA program funding for the next few years.

Facilities in Korea have required upgrading for some time. Because it was not legislated that U.S. troops would be permanently stationed in Korea, temporary facilities (5-year life) have served as permanent ones (25+ years). This caused a facilities modernization/upgrade requirement of significant proportions. These temporary facilities have been repaired and patched many times, without adequate records and/or drawings of the changes. Consequently, when facilities undergo improvements, contractors frequently encounter surprises. Typically, in addition to expected wear and tear, structural forming integrity is destroyed by rust or rot, foundations are inadequate, wiring is inadequate and not recessed, sanitary facilities are primitive (even external to living quarters), and air conditioning is nonexistent.

Since many of these conditions are not obvious when work is started, each unknown condition results in some type of construction modification request which needs processing. These unknowns caused the majority of OMA modification actions during FY 81-83, when a big OMA funding increase was experienced (Figure 2). Figure 3 shows the MCA/OMA funding strategy EUSA has adopted, wherein MCA funding is targeted for temporary structures, thus reducing previously identified renovation requirements (OMA projects). This, in turn, should reduce the number of future OMA projects and modifications, since OMA projects for newer facilities ordinarily require less OMA funds and have good documentation.

Figure 4 shows how the new MCA Program will improve EUSA's Backlog of Maintenance and Repair (BMAR) condition--a rapid decline to $20 million by 1990. By 1990, most of the renovation should be complete.

Workforce Factors

The increased MCA/OMA funding created problems. Initially, FEA-K and FED lacked adequate organizational structure and personnel. The organizations have been restructured and personnel have been added. Considering the large program increases and the engineering workforce understrength, FEA-K's and FED's placement of so much MCA/OMA work is a notable achievement.

Historically, no requirement existed for a large FEA-K workforce since there were no major facility initiatives. In fact, the small FEA-K workforce had never been a problem until the beginning of the '80s, when the workload expanded rapidly. Presently, there are very few Department of the Army Civilians (DACs) in FEA-K. Civilian positions are vacant approximately 3 or more months before being filled, creating a discontinuity of personnel and loss of institutional memory, since there is no overlap in a given position. The successor has few (if any) persons from whom to glean project-related information.

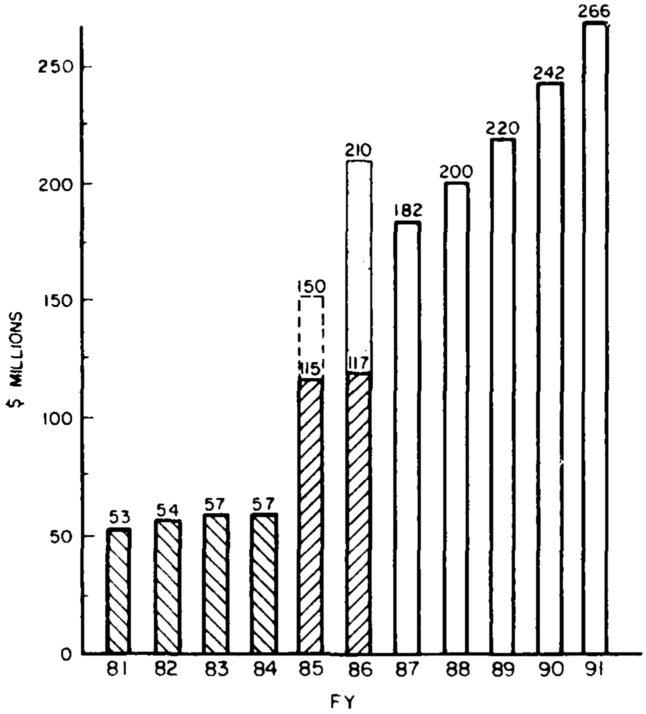

Figure 1. Planned MCA program funding.

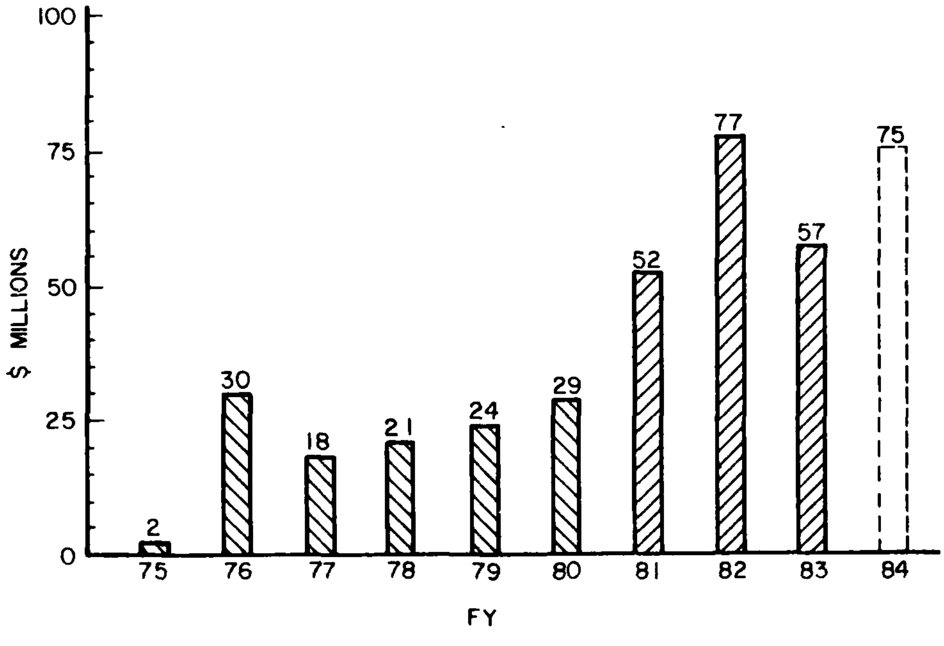

Figure 2. OMA project funding history.

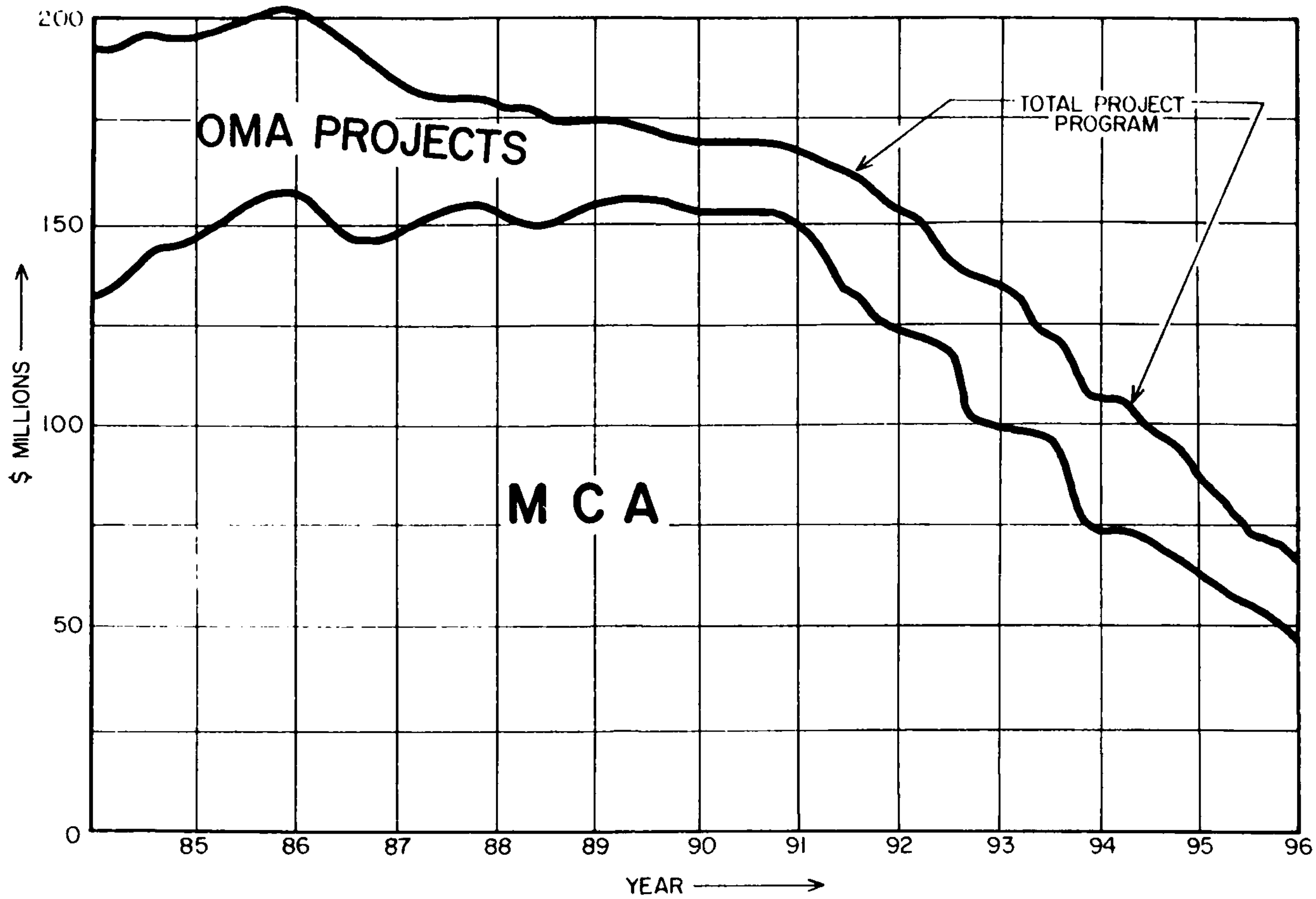

Figure 3. EUSA BMAR reduction via enhanced MCA program.

Year	Beginning BMAR ($ Millions) Previous Projection		Enhanced MCA Program
1979	43		
1980	144		
1981	181		
1982	181	Reported	
1983	162		
1984	149		
1985	135		135
1986	119	Projected	80
1987	103		60
1988	83		40
1989	63		30
1990	50		20
1991	40		20

Figure 4. EUSA BMAR reduction via enhanced MCA program.

The military situation is similar. Incumbents rarely overlap their replacements, and if they do, it is only for a week or two, with very little project information to be passed on. Furthermore, since tours are short (1 year unaccompanied, 2 years accompanied), virtually no one, either user representative or FEA-K civilian or officer, was present when a project was initiated.

Most engineer personnel slots in the FEA-K organization tend to be in the GS 5 to 12 range. There is only one GS-14 and several GS-13s, all of whom are branch chiefs. Because of this low grade structure, personnel tend to be either older, with much experience and not much inclined towards seeking promotion, or younger, looking for experience. The average age of the FEA-K workforce is approximately 42.

Communications

Communications, both verbal (Korean-English/English-Korean) and electronic (telephone, computer) have many shortcomings. With the Korean Augment to the U.S. Army (KATUSA) workforce not having a full command of English, much time is spent repeating job instructions.

Poor telephone service compounds communication problems to, from, and within Seoul. It also greatly degrades effective use of the automated tools supporting planning and programming activities--such as the Programming, Administration, and Execution System (PAX), including the DD Form 1391 Processor, the Construction Appropriations, Programming, Control, and Execution System (CAPCES), and the PAXMAIL message capability. As things stand, FED and FEA-K, only 3 or 4 miles (1.86 to 2.48 km) apart, have no practical electronic communication with each other or with their many subordinate offices (all within a country the size of Indiana) or with the United States (the Tymshare PAX contract notwithstanding). In Yongsan, where telephone lines are considered to be the best, when anyone with a deadline signs on to the DD Form 1391 Processor to send forms to the Office of the Chief of Engineers (OCE), the line often fails.

Even more disconcerting is the lack of knowledge of CAPCES and PAX utilities. While visiting FEA-K, it was evident that the FEA-K managers engaged in planning, programming, and project management activities were unaware of PAX in general and CAPCES in particular. Uniformly, a keyboard/printer, used (probably) exclusively for DD Form 1391 preparation and PAXMAIL, was pointed to as "our DD Form 1391 Processor," or referred to in terms such as "We have a DD Form 1391 Processor." Access to PAX in general and CAPCES in particular would be valuable. Unless an FEA-K employee comes to Korea with knowledge about PAX/CAPCES, there is little chance that he or she can pick it up unless training sessions are brought to Korea, since going to the United States just to learn CAPCES might be impractical.

External Factors

As with grade ceilings, communications, and program workload size, many of the problems impacting modification processing are beyond the ability of FEA-K to change. Two of the more significant problems are: financial constraints (1 yr OMA Funds) and U.S. Army Corps of Engineers (CE) military construction standards.

Financial Constraints

Unlike MCA projects financed from funds with a 5-year life, with an amount set aside for contingencies, OMA projects are by regulation financed from funds authorized for expenditure in the fiscal year in which the project was started. If construction of these OMA projects carries over into the next fiscal year and additional funds are required for modification of the existing contract, prior year funds must be obtained. The EUSA Finance and Accounting Office (EAST-FAO) controls prior year funds and the FEA-K Program and Budget Office (EAFE-R-PB) must get EAST-FAO authorization, involving an average 1-week delay with a maximum 3-week delay. A significant delay of at least 1 month occurs when EUSA has no prior year funds and must request additional monies from HQDA, Washington, D.C. This is perhaps the biggest delay originating within the FEA-K environment.

CE Military Construction Standards

Building to CE military construction standards delays construction modifications because the standards invariably require materials which can be procured only from the United States. CE standards are much higher than Korean standards, meaning Korean products are rarely satisfactory, particularly in the electrical, mechanical, or safety areas, but also in low technology areas such as floor coverings. Ordering materials from the United States may cause 6 months or more delay.

The CE military construction standards are especially problematic to FEA-K and users within EUSA because Quonset huts are scheduled for replacement within a few years. Korean materials (nonsafety, electrical excluded) could meet this time requirement but if CE standards are strictly followed, project completion might be delayed.

3 THE CONSTRUCTION CONTRACT MODIFICATION PROCESS

The construction modification process employed by FEA-K is a series of formal (requiring documentation) and informal (primarily oral agreements) activities conducted among various offices within FEA-K and FED to effect changes in construction projects.

Figure 5 outlines the information flow of the overall modification process. Some of the actions occur conditionally. For example, the block diagram has two modification starting points (origins): (1) the Users--Major Subordinate Commands (MSCs) or other EUSA assigned units/activities and (2) the U.S. Army Engineer District, Far East (FED) resident or project office. Additionally, the Area Facility Engineer can originate field or design changes, when construction is by the U.S. Army Korea Contracting Agency (EAKC, more commonly known as the KCA).

The block diagram is constructed by organization or office, rather than individual. Several individuals within an office may be involved with one modification, depending on skills required for modification processing, as within the FED Engineering Division (POFED). Some potentially involved offices are not shown. For example, POFED interaction with an Architect-Engineer (AE) includes action by FED Procurement and Supply Division (POFSP). Also, FED litigation with a contractor will involve the FED Office of Counsel (POFOC). Some rarer omitted activities are higher-level approvals required by ER 1180-1-1 and by DAR paragraphs 18-402.3 (ii), (vi), (viii), and (ix) when certain dollar thresholds are exceeded.[1]

Figure 6 shows, in greater detail, the activities conducted within HQ FEA-K (the area bounded by a dashed line on Figure 5) when processing an OMA change request originating from the field. Since projects at FEA-K are managed by geographical area, hypothetical changes from Camp Casey (North section) are illustrated. Figure 7 provides time values for the activities shown in Figure 6. These values assume that all supporting documentation (cost estimate, design changes, etc.) arrives with the change (modification) request.

[1] Engineer Regulation 1180-1-1, *Engineer Contract Instructions* (Office of the Chief of Engineers, 1 July 1980).

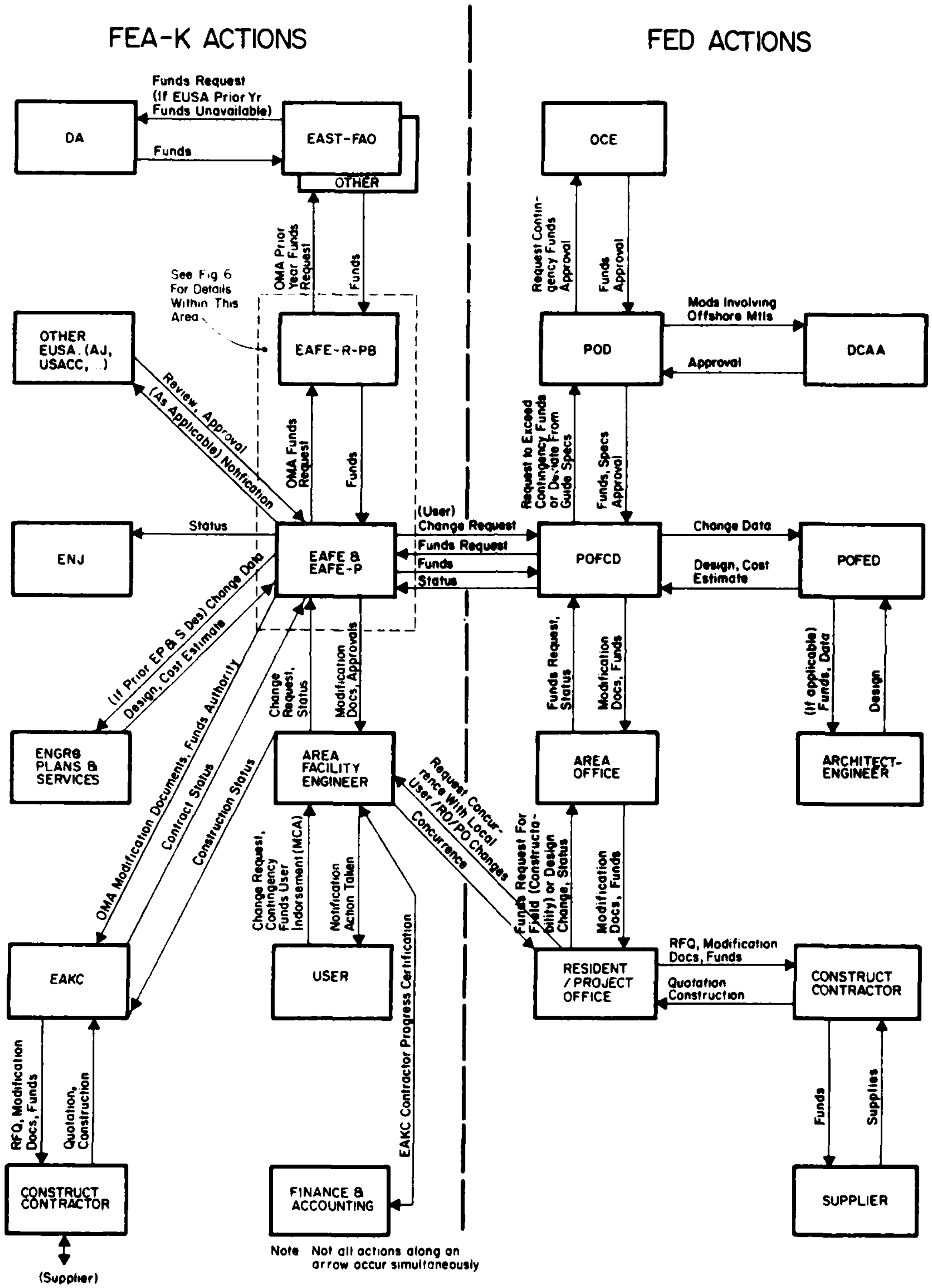

Figure 5. Contract modification information flow.

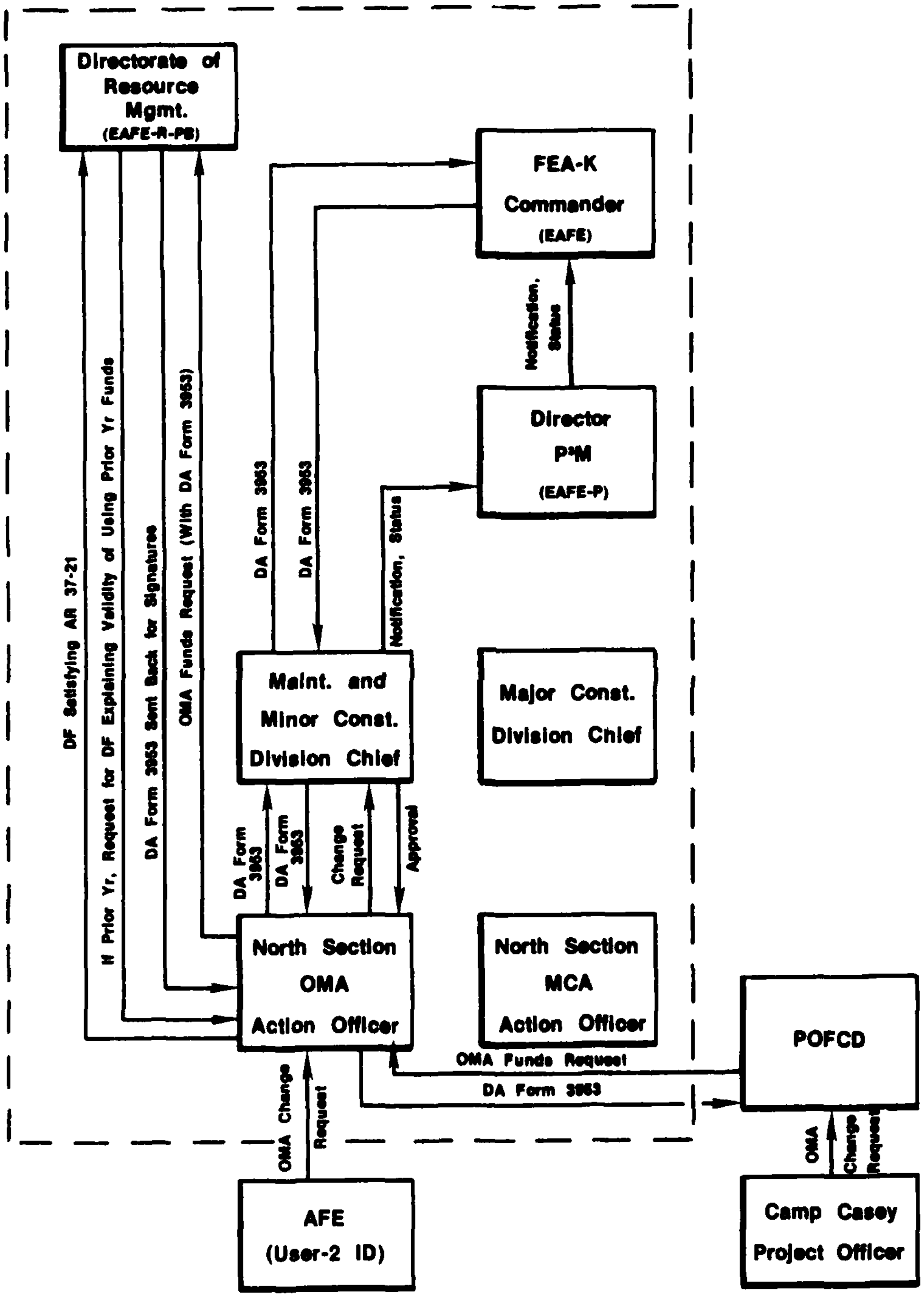

Figure 6. Details of EAFE/EAFE-P and EAFE-R-PB OMA funds request activities. (Camp Casey, Typical)

No.	Activity	Est. Time Calendar Days	Comment
1.	OMA Action Officer Forwards (AFE/FED) Request to EAFE-R-PB by letter.	14	
2.	EAFE-R-PB Requests OMA Action Officer to Prepare DF Satisfying AR 37-21 Rqmts	14	Prior year funds required
3.	EAFE-R-PB Processes DA Form 3953	42	Assumes a 40-modification backlog
4.	EAFE-R-PB Requests Funds From EAST-FAO	21	Prior year funds required
5.	EAST-FAO Requests Funds From HQ DA	30	No EUSA prior year funds available
6.	OMA Action Officer Forwards DA Form 3953 to Division Chief and CDR FEA-K for Signatures	21	
7.	OMA Action Officer Forwards Funds Documents to POFCD	14	
	TOTALS	77	AFE Origination, current year funds available
		112	AFE Origination, EUSA prior year funds required
		142	AFE Origination, HQDA prior year funds required
		+14	POF Origination

Figure 7. Estimated OMA funds request processing time.

4 FEA-K AND FED IMPROVEMENT INITIATIVES

FEA-K Initiatives

Two actions underway within FEA-K, destructive testing and interorganizational coordination, will yield major dividends in the effort to reduce the number of modifications and improve processing.

Destructive Testing

Recently instituted as an integral part of the predesign effort, destructive testing is playing an important role in reducing the number of modifications required in OMA projects. Destructive testing is a procedure in which small portions of building elements (i.e., ceiling, walls, foundation, etc.) are destroyed to expose the condition of those parts. Prior to destructive testing, OMA projects experienced many modifications, because when buildings were torn apart, unexpected conditions of building components were uncovered. Learning of the extra work the defects implied, contractors sought modifications. Destructive testing reduces surprises and consequent modifications, with a relatively minor cost for a more thorough early investigation, and subsequent repair of investigative damages.

Interorganizational Coordination

Communication between FED and FEA-K has improved dramatically over the past year. Both groups have recognized that a large, complex workload, managed by two commanders, requires special attention to interorganizational cooperation, coordination of information, common or complementary practices, cross-training, and anticipating and avoiding potential conflicts.

FED Initiatives

At FED, the climate for reducing the need for modifications and improving their processing seems excellent. FED management wholeheartedly endorses an investigation, which might lead to improvement as the recent POD modification processing study attests. In addition to the study, FED has initiated a new policy to handle design review comments.

POD Study

The POD study team finished its analysis for FED at the time it met with the USA-CERL team. POD oral recommendations on FEA-K - FED modification processing interaction are that:

1. FED establish a formal schedule for its project managers and Office Engineering Branch (POFCD-O, or OEB) to talk with FEA-K Area Facilities Engineers (AFE) and customers more often, perhaps once or twice a week.

2. FED establish a formal suspense system for funding actions and for the total modification process. It should be automated, containing target times and exception listings, with follow-up actions documented.

3. FED establish an agreement with FEA-K on fund request priorities for (a) constructibility, (b) Supervision and Administration (S&A), and (c) funds revocation, preferably in the order given.

4. CDR FED present a status of FED funds requests to CDR FEA-K every 2 weeks.

5. FED establish an informal modifications management group to guide the development of an automated management control system.

AE Followup on Design Review Comments

FED has established a policy that all AE design efforts must include, as part of their final design submission, written statements explaining the disposition of design review comments, citing specification page and paragraph number, as well as drawing and detail number. This action should stop designs being advertised with known deficiencies. Additionally, it should provide FEA-K and their customers with a sense that their input is being considered and acted upon.

5 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Modification processing slowdown was largely caused by an increasing program, aggravated by projects with unknown facility conditions which, in turn, bred an abnormal number of modifications. An understaffed workforce lacking institutional memory and overlapping tours for any given position added to the problem.

Modification processing time has improved, and can become better. It was and still is burdened by the need to coordinate the actions of many people of different agencies, each agency having its own set of priorities. Also, each organization is not fully aware of the other organizations' policies, processes, activities, procedures, and modifications status.

Recommendations

Construction contract modifications will never be totally eliminated, but their numbers can be reduced. No single action can bring about this improvement. A variety of diverse but complementary actions by different organizations are recommended. They are divided into three distinct categories described below: avoiding modifications, improving the modification process, and enhancing the workforce's capabilities.

Avoiding Modifications

1. Create EUSA Modification Policy. Establish EUSA policy on using agency modification/change request as to types and time period of allowed changes (similar to Air Force's, contained in Appendix B). Reduction in user modification requests should result. Now, users have no authoritative modification approval guidelines. The only way they can find out is to submit a change request and see what happens. Typical policy may include items such as: (1) no modifications after foundations completed, or (2) no modifications for aesthetic reasons, etc.

2. Sustain Destructive Testing Initiative. Sustain the new FEA-K policy to perform thorough site investigations (including destructive testing) to uncover hidden site, utility, and facility conditions. Also reverify those conditions for designs which have been shelved for a year or more.

3. Perform Oversight on Disposition of Design Review Comments. Encourage FED in its new policy of binding all review comments together as a single design annex (drawings delineated by drawing number and detail number, specifications delineated by page number and line number) and ensure that Plans, Programs, and Project Management Directorate (P^3M) project managers or AFEs check to be sure that FEA-K/AFE/User design comments have responses.

Improving Modification Processing

1. Enhance Management Controls. Introduce formal management controls within FEA-K, including:

a. Suspenses based on realistic activity time estimates.

b. Tracking/status reporting, including exception reports (biweekly report to FED).

c. Assignment of FEA-K modification tracking responsibilities.

d. Regularly scheduled FEA-K and FEA-K/FED management review meetings.

2. Increase Participant Awareness. Establish FEA-K modification processing Standard Operating Procedure (SOP), including:

a. Priority processing scheme.

b. Activity network. By activity: description, realistic duration time estimate, responsible action officers/offices, forms used and their destination, etc.

c. Authority redelegation to cover personnel absences.

d. SOP distribution and briefing list.

3. Pursue Time-Shortening Opportunities.

a. Re-examine the modification processing activity network to determine time-shortening opportunities, specifically:

(1) Needless approvals (e.g., at FED, POFCD-O reduced a 15-step approval to one step).

(2) Removing activities from the critical path (e.g., information copy substituted for approval action wherever possible, with go-aheads unless objection).

(3) Redelegation of authority so absences do not delay approvals.

b. Establish an EUSA policy on use of local materials. Permit local materials for renovation of aged Quonset huts, other buildings with limited immediate life, or those targeted for demolition by 1990. Also, emphasize limiting design life of renovation projects, thereby encouraging the use of local materials (safety-related materials excepted).

4. Improve Communication/Coordination with FED. Ensure that the two major organizations know what the other is doing, what its beliefs are, and what data it is acting upon and making decisions from. Once differences in understanding are recognized to occur, corrective actions can be taken. Improved coordination includes:

a. Assurance that FED procedures provide prompt or regular notification to FEA-K of stop work orders.

b. Encouragement of FED to submit its Contract Change Status Report (and the Contract Change Exception Report when it becomes available to FEA-K).

c. Exchange by FEA-K Commander and FED Engineer of copies of the POD and USA-CERL modification studies and of actions taken on studies recommendations.

5. Provide Funding Flexibility. Funding flexibility has two goals: to speed modification flow and to reduce the mass of finance and accounting (F&A) transactions. One specific area of sustained interest is investigation of opportunities for bulk OMA Supervision and Administration funding to FED to provide easier delivery.

Enhancing Workforce Capabilities

1. Conduct Manpower Study. Conduct an official manpower study to reinforce/justify FEA-K needs. Address at a minimum:

a. FEA-K manpower authorizations which do not reflect workload requirements.

b. FEA-K turnover, requiring 10 percent overstrength for Department of the Army Civilians, with 2 months overlap in tours to improve institutional memory, and training/orientation of personnel.

c. Recruitment problems and lack of qualified engineers with appropriate experience; increased recruiting/advertising (e.g., advertisement in trade magazines, *Civil Engineering*, and other engineering trade publications); hiring of retired annuitants.

2. Develop Automated FEA-K Modification Tracking System. Pursue the development of an automated FEA-K modification tracking system, integrated with the developing FED tracking system, to improve and contribute to mutual understanding and awareness. A detailed concept of such a system and tools is contained in Appendix A. This is a key recommendation, because ability to manage a process depends directly on knowledge of the process.

3. Vigorously Advocate Improved Electronic Communication. Aggressively pursue improved electronic communications throughout FEA-K/EUSA and with FED to make available those ADP capabilities commonly available to other Army engineers throughout the world.

4. Seek PAX/CAPCES Training for FEA-K Personnel. Bring PAX/CAPCES training to Korea, by arrangement with the proponent office (DAEN-ZCP-M).

5. Conduct an HQ FEA-K Decision Support System Needs Study. Employ microcomputers. Microcomputers (personal computers) are playing an increasing role in automating Major Army Command (MACOM) engineer HQs and Directorate of Engineering and Housing (DEH) offices in the Continental United States (CONUS). The advantage to EUSA/FEA-K would be independent computing/office automation technology at low cost. It would improve institutional memory, enhance forms processing, and provide immediate status of activities. Software is readily transportable from one type personal computer to another and requires very little training to use. Its payoff would be significant.

APPENDIX A:

CONTRACT MODIFICATION TIME—TRACKING AND ANALYSIS TOOLS

CONTENTS

Information is required to manage modifications individually and in mass, and to improve management. The only way to acquire such information is by observing (tracking) modification process activities. By tracking individual modifications, status is known, action can be taken as needed, and completion can be projected. By evaluating many modifications, it is possible to set realistic activity performance goals and to identify activities requiring greater attention or simplification.

This appendix explains how tracking and analysis can be done, in terms of the overall modification process, contract modification activity networking, and related data processing. Critical Path Method (CPM) procedures are being implicitly applied. However, through use of standard networks, standard time estimates, a data base management system, and thorough automation, it is possible to reduce the user input to a fraction of traditional CPM input, while dramatically increasing the informational value and clarity of output.

Contract Modification Network

Activities

Figure 5 displays the overall modification process from an information flow viewpoint.

Table A1 translates the Figure 5 process information flow diagram into those activities which significantly affect modification time. Some informational activities do not constrain delivery (for example, status reports). Even as Figure 5 does not show all actual or potential organization/office flow, neither does Table A1 show all activities. Rather, the intention is to show the major offices and a reasonable number of checkpoints, dispersed at reasonable time intervals.

Selection of the kind and number of network activities depends ultimately on managerial style. Given two sources of data, an agreement between FEA-K and FED on the joint network is required.

Successor Activities

Table A1 shows activities in the three main groups of the preceding table (OMA/FEA-K, OMA/FED, and MCA/FED). Each activity has a successor activity, except for the nonconstraining Activity 14, AFE Review of Modification Documents, and terminal Activity 18, Construction Contract Time Without Offshore Supplies. Few parallel activities exist (i.e., few activities have two or more successors). The implicit network type is activity-on-node.

Data Sources

Table A1 shows data entry by either FEA-K (presumably EAFE-P) or FED (presumably POFCD). Each activity has a single source, except for Activities 17 and 18, procurement and construction times following modification award. Data entry for Activities 17 and 18 are by the constructing organization, FEA-K or FED.

Estimated Time in Calendar Days

Table A1 presumes that realistic standard time estimates can be made for all 34 activities except the three start activities (1, 2, and 19) and Activity 18. The completion date of a start activity is of greater interest than the start date. The start activities are Activities 1 and 2 for FEA-K user change requests and Activity 19 for FED field (constructibility) or design change requests. It can be said that FEA-K and FED have no knowledge of a modification until there is a request, so the clock does not start for a modification until there is a request. It follows that all time intervals can be defined by completion dates, since the start date of a start activity is irrelevant and the start dates of all succeeding activities are completion dates of prior activities. Activity 18, construction time, is too variable to permit a standard time estimate, requiring this estimate to be manually entered as initial modification data entry.

It has been specified that time estimates are in calendar days, including weekends and holidays. There is a problem in combining short (workday oriented) and long (calendar-day oriented) time estimates. Some adjustment of the short intervals needs to be made to account for weekends.

Table A1

Contract Modification Activities

NO.	ACTIVITY	SUCCESSOR ACTIVITIES OMA/ FEAK	SUCCESSOR ACTIVITIES OMA/ POF	SUCCESSOR ACTIVITIES MCA/ POF	DATA SOURCE FEAK	DATA SOURCE POF	EST. TIME CAL. DAYS	CONDITION
1	User Change Request Preparation	3	3	2	X		--	User (Not Field/Design) Change
2	User Indorsement of Contingency Funds Use			3	X		--	MCA, in Parallel with Activity 1
3	AFE Change Request Processing	4	4	4	X			--
4	EAFE-P Change Request Processing	5	21	21	X			--
5	EP&S Design, Specifications, Cost Estimate, and Time Est	6			X			OMA, If Prior EP&S Design
6	EAFE-P Review and Processing of Modification Documents	7	7	7	X			--
7	Other EUSA (AJ, USACC, ...) Review and Approval	8	8	13	X			Reqd Coord for NAF, Comms,...
8	EAFE Change and Funds Request Review and Approval	9	9		X			OMA
9	EAFE-R-PB Funds Request Processing	10,12	10,12		X			OMA, Same Year Funds Approval
10	EAST-FAO Funds Request Processing	11	11		X			OMA, EUSA Prior Yr Funds Approval
11	DA Funds Request Processing	13	13		X			OMA, No EUSA Prior Yr Funds Avail
12	Reimbursable Projects Funds Request Processing	13	13		X			Other Agency, No Contingency Funds
13	EAFE-P Distribution of Modification Documents, Funds	14,15	14,31	14	X			--
14	AFE Review of Modification Documents	--	--	--	X			--
15	EAKC Modification Processing and RFQ	16			X			OMA, If Prior EP&S Design
16	EAKC Constructor Response to RFQ and Negotiation	17			X			OMA, If Prior EP&S Design
17	Construction Contract Offshore Procurement Time	18	18	18	X	X		Offshore Materials Required
18	Construction Contract Time Without Offshore Supplies	--	--	--	X	X	--	Contract Time Period Varies
19	POF Res/Proj Off Field/Design Change, Funds Request Prep		3,20	3,20		X	--	POF, Field/Design (Not User) Change
20	POF Area Office Change Request Processing		21	21		X		POF, Field/Design (Not User) Change
21	POFCD Change Request Processing: Incoming		22	22		X		POF
22	POFED Change Request Processing: Scope and Cost Estimates		23	23		X		POF
23	POFED AE Contract Mod Prep, RFQ, AE Quote, Negotiation		24	24		X		POF, Design Change by AE
24	DE/AE Design, Specifications, Cost Est, and Time Est		25	25		X		POF
25	POFED Review of Modification Documents		26	26		X		POF
26	POFCD Review of Modification Documents, Distribution		27,30	6,28,30		X		POF
27	POFCD Direct Construction Cost and S&A Funds Request		6			X		POF, OMA
28	POD Approval to Exceed Conting Funds, Deviate from Stds			29		X		POF, MCA, Conting Funds/Specs Vars
29	OCE Approval to Exceed Budgeted Contingency Funds			31		X		POF, MCA, Conting Funds Exceeded
30	POF Area Office Review of Modification Documents		31	31		X		POF
31	POF Resident/Project Office Review of Mod Docs, RFQ		32	32		X		POF
32	POF Constructor Response to RFQ and Negotiation		33	33		X		POF
33	DCAA Review of Quotations for Offshore Materials/Equip		34	34		X		POF, Offshore Materials Required
34	POF Contract Modification Award Approvals		17	17		X		POF

Conditions

The righthand column of Table A1 shows the conditions under which activities exist. These conditions become the basis for limiting data entry and for computing total estimated modification time.

Are 34 activities a reasonable number? In comparison, the military construction predesign phase, from first design directive to AE contract award, has been found to be easily manageable with 32 activities. What about the data entry load (primarily actual completion dates)? Since many activities are conditional, the number of dates varies, as tabulated in Table A2.

Initial Data Entry for Network Selection and Schedule Creation

Figure A1 shows 12 initial data entry items, the first 10 of which are conditions implied by the conditions (last) column of Table A1. These conditions are used for activities selection. Network schedule creation is possible by using values of the 10 conditions and the last two Figure A1 items, the (nonstandard) modification construction time estimate and the change request initiation date.

Network Selection

Initial specification of the values of the 10 conditions permit simplification of the 34 Table A1 activities to no more than 26 and no fewer than eight activities for a particular modification. Each condition can be represented by a single keystroke letter. Given adequate computer programming, a simplified network can be saved for each modification. Thus, network examination and updating can be restricted to relevant activities.

Time Estimation

A complete schedule, listing activities and estimated completion dates for the entire modification process can be generated easily, given the:

- List of relevant activities specified by the 10 initially entered conditions
- Support file of activity standard time estimates (Activities 3-17, 19-34)
- Modification construction time estimate, entered initially
- Change request initiation date, entered initially.

Optional Initial Data

A capability to initially override activity standard time estimates or enter other data can be provided.

Table A2

Effect of Limited Completion Dates

Activities Group	Number of Completion Dates Entered By FEA-K Min.	FEA-K Max.	FED Min.	FED Max.	FEA-K & FED Min.	FEA-K & FED Max.
OMA Project, FEA-K Construction	8	16	--	--	8	16
OMA Project, FED Construction	7	11	11	16	19	26
MCA Project, FED Construction	6	8	10	17	18	23

Data Base

Data Base Structure

The project data file structure is:

Level 1 Project Identifier (as a minimum, Project Number and Station)

Level 2 Project Data
Modification Identifiers (Modification Numbers)

Level 3 Modification Data
Modification Activity Identifiers (Activity Numbers)

Level 4 Activity Data

The presumption is that an Automated Military Progress Reporting System (AMPRS) type structure is used. Thus, the AMPRS project corresponds to the Construction Appropriations, Programming, Control, and Execution (CAPCES) subproject, one AMPRS project having one corresponding construction contract. Management by construction contract, rather than project, poses the problem that one contract can have many projects.

The one support file required, applicable to all projects and their modifications, consists simply of activity numbers and their associated activity standard time estimates and activity descriptions.

Estimated modification costs are sensitive (For Official Use Only) and may not be accessed by contractors. Otherwise, it is presumed that everyone has a legitimate claim to access any data, and will not use it irresponsibly. Of course, the system could be designed otherwise at greater cost of time and money.

The proposed data base structure contains 19 data elements per project, six data elements per modification, and six data elements per activity. (As mentioned previously, there are eight to 26 activities per modification out of 34 unique activities.) This structure appears to meet immediate and foreseeable headquarters and local data needs. Of

ITEM

DATA ENTRY VALUE

DATA ENTRY MEANING

DATA SOURCE ENTRY OFFICE
- E EUSA Office
- P POF Office

CHANGE TYPE
- U EUSA User Change
- D POF Design Change
- F POF Field Change (for constructibility)

FUNDS TYPE
- O OMA (or similar type)
- M MCA (or similar type)

OMA FUNDS SOURCE
- S Same Year Funds, EAFE-R-PB Processing Only
- P Prior Year Funds, EAST-FAO Processing for EUSA Availability
- D DA Processing, No EUSA Prior Year Funds Available
- R Reimbursable Projects Funds Processing by Other Agencies

MCA CONTINGENCY FUNDS SOURCE IS OCE?
- Y Yes
- N No

DESIGN STANDARDS DEVIATIONS APPROVAL BY POD IS REQUIRED?
- Y Yes
- N No

MODIFICATION DESIGN CHANGE TO BE DONE BY POF AE?
- Y Yes
- N No

MODIFICATION DESIGN CHANGE TO BE DONE BY EAFE EP&S?
- Y Yes
- N No

REVIEW BY EUSA OFFICES OTHER THAN EAFE (E.G., AJ, USACC,...) IS REQUIRED?
- Y Yes
- N No

CONSTRUCTION REQUIRES OFFSHORE MATERIALS?
- Y Yes
- N No

CONSTRUCTION TIME ESTIMATE FOR MODIFICATION
- I3 Integer, Three Digits, Calendar Days (including weekends and holidays)

CHANGE REQUEST INITIATION DATE
- I6 Integer, YYMMDD, User or Field/Design Initial Change Request Date

Figure A1. Initial data entry for network selection and schedule creation.

course, no previous system design has provided insight to isolate all immediate needs, or vision to ably forecast future needs. A good example is the Corps-wide AMPRS. The standard, centrally maintained AMPRS provides a wide variety of reports and has a flexible data base structure allowing local variations. As of mid-1982, the approximate size of the standard routines was 60,000 lines of source code. However, local users were eager to adapt and expand usage to the extent of adding approximately 385,000 lines of source code to their local processors. An implication is that users are willing to invest time and money in expansion, if given the capability. The modification tracking system should be designed to allow additional project, modification, and activity data elements and added activities.

Project Data Elements

Figure A2 shows 19 AMPRS project data elements, all of which should be available for FED-managed OMA and MCA projects. (Field format specifications precede the data element names.) Although many more data elements are needed for design and construction management, this subset should be adequate for modifications. Of these, the four listed below traditionally have been required to satisfy the AMPRS project identifier uniqueness theorem. It is now thought that only the first two are required.

- Project Number
- Station Code
- Authorization Year
- Type Funds Code

There is a problem on how to handle the Project Engineers Names data element. Apparently, multiple names are allowed. The problem of extracting the proper name for the proper report may be treatable through the related Project Engineers Code and some programming. Note that both FEA-K and FED have project engineers for a given FED-constructed project.

Modification Data Elements

Figure A2 shows 16 AMPRS modification-related data elements, all of which should be available for FED-managed OMA and MCA projects. This 16-element file was designed to support both modifications and current working estimate transactions. Given that modifications only are involved and that Figure A1 initial data and activity network data are available, only the six below are of any significance:

- Modification Number
- Modification Description
- Contract Time Change
- Contract Cost Change
- Contract Performance Time (total, including this change)
- Contract Cost (total, including this change)

AMPRS DATA ELEMENTS

PROJECT DATA ELEMENTS (Higher Level, 144 Characters)

A3	Construction Agent
A7	Project Number
A6	Station Code
A28	Station Name
A7	Facility Class and Construction Category Code
A15	Project Description (AR 415-28 Short Title)
I6	Scope
A2	Unit of Measure Code
A1	Type Construction Code (P, S, or T)
I2	Authorization Year
I2	Program Year
I2	Type Funds Code
I12	Control Cost
I12	Current Working Estimate, Current
I6	Construction Contract Award Date, Current
I6	Construction Start Date, Current
I6	Construction Contract Completion Date, Expected
A9	Construction Contract Number
A12	Project Engineers Names

MODIFICATION DATA ELEMENTS (High Interest Items Have an Asterisk)

A5	Serial Number (unnecessary when modifications only are involved)
I6	Inception Date (provided by network, below)
A6	*Modification Number
I6	Signature Date (provided by network below)
A40	*Modification Description
A3	Originating Agency (there is only one)
A1	Stage Code (provided by network below)
A2	Status (provided by network, below)
I6	Status Date (provided by network below)
I4	*Contract Time Change
I10	*Contract Cost Change
I3	*Contract Performance Time (Computed)
I12	*Contract Cost (Computed)
I3	Modification Age (Claims and Pending Items, Not Signed Mods Age)
A1	Modification Type (U for Unilateral, T for Two-step procurement)
A1	Transaction Code (unnecessary, given Figure 3 type data)

MODIFICATION NETWORK DATA ELEMENTS

ACTIVITY DATA ELEMENTS (34 activities)

I2	Activity Number
I6	Activity Completion Date, Actual
I3	Activity Estimated Completion Time, Cumulative (Computed)
A40	Activity Extenuating Cause for Allowing Extra Time

ACTIVITY INITIAL DATA ENTRY

A10,I9 (See Figure 3)

ACTIVITY SUPPORT FILE (30 of 34 activities)

I2	Activity Number
I2	Successor Activities
I3	Activity Standard Time Estimate
A40	Activity Description

*Significant data elements.

Figure A2. Modification-related data elements.

Some financial transactions have not been included, such as FED OMA funds requests values for Supervision and Inspection (S&I) costs and Direct Construction Costs (DCC) which are included in a biweekly FED OMA Funds Request Report to EAFE-P.

Modification Activity Network Data Elements

Figure A2 shows the activity data elements and the previously mentioned activity initial data entry (Figure A1) and the activity support file discussed under *Data Base Structure*, above.

As a minimum, the activity data elements should be the activity number, activity actual completion date (as it becomes available), cumulative estimated completion time from initial submission of the change request until the associated completion date (computed), and any extenuating reason(s) for allowing time substantially greater than the standard time estimate.

The cumulative estimated completion time, computed from standard time estimates and the initially entered nonstandard modification construction time estimate, yields an *originally* estimated completion date, when added to the initially entered change request initiation date. Given the cumulative time estimate and completion date for the last completed activity and the cumulative time estimate of any future activity, the *currently* estimated completion date of the future activity can be computed.

The narrative extenuating reason for allowing time substantially greater than the standard time estimate is used in lieu of an AMPRS type delay code structure. AMPRS records a primary and secondary delay code at the project level. Unfortunately, current delay codes are used and most historical information is lost on project completion. A formal delay code structure presumes prior knowledge of the significant delay causes and imposes a rigid structure. The delay code allows simplified data input and output (at the expense of manual translation of the codes) and, properly used, is ideal for simplified analysis. A disadvantage of delay codes is that exceptions to the code structure are not encouraged. Any change in code structure complicates later analysis. In the case of modifications, the causes of time overruns have not been given extensive thought with respect to creating a delay code structure. Also, modification time overruns may not necessarily involve delays in the conventional sense. Recall that the proposed activity network is structured to include activities which always or frequently occur, not every potential activity. Therefore, it is recommended that extenuating reasons for time substantially greater than standard time be recorded as text, at least for the near future.

"Time substantially greater than the standard time estimate" means perhaps a 50 percent excess time. Individual activity overruns will be greater than the average overrun (if any) of a group of activities.

Data Processing

Putting the foregoing into action requires explanation of the data processing environment, input, output, and supporting computer programs.

Environment

FEA-K has a Wang VS 80 computer with 256 kilobytes virtual storage. There are 16 ports, serving nine terminals, a 600-line/min printer, a tape drive, and two 75-megabyte disk drives. Within a year, it is planned to upgrade to a Wang VS 100 with 2 megabytes

virtual storage, and 32 ports serving 23 terminals, the printer and tape drive, and two 288-megabyte disk drives. Installed general-purpose software is all Wang and has the nature of small utility programs. Installed communications is minimal. The only communications by commercial line uses the Wang as a terminal to FEA 4-Phase computers in Taegu and Pusan. Access to Tymshare is not made through the Wang terminals but by other terminals. Tymshare now provides 1200-baud communications at no cost because Tymshare has no 300-/1200-baud switching capability for Korea. Within a year, the Wang should be connected to the U.S. Army Garrison, Yongsan IBM 4341 and to on-base, 4341-served organizations by a Wangnet local area network.

The best Wang Data Base Management System (DBMS) which may be installed hare has no 300-/1200-baud switching capability for Korea. Within a year, the Wang should be connected to the U.S. Army Garrison, Yongsan IBM 4341 and to on-base, 4341-served organizations by a Wangnet local area network.

The best Wang Data Base Management System (DBMS) which may be installed is DMS and it is very limited in capabilities. Wang communications emulation which can be installed includes: 3270, 3271, SNA, P2Y, 2780, and 3780. Thus, the Wang can be given various communications capabilities--synchronous or asynchronous, interactive or batch processing.

FED has a Harris 500 computer. There are 54 ports serving 61 terminals, 12 Nippon Electric Company (NEC) printers, and two 300-megabyte disk drives. Major software includes FORTRAN, COBOL, and INFO. INFO appears to be a high-level DBMS. AMPRS-type data are transmitted from the U.S. Army Engineer District, Far East (POF) by AUTODIN and received by magnetic tape. Currently, the Harris has 2780 emulation installed and is being tested for communication with POD.

Thus, in this environment, it appears that the greatest capability can be furnished FEA-K and FED, at least cost (avoiding duplicate programming and tape handling) and with immediate access, by using the more powerful Harris as the main processor with the Wang as a Harris terminal. However, compatible communications must be established between the two computers.

Microprocessor Technology

Unintelligent terminals accessing a central mainframe computer may be presumed in the report, a capability corresponding to current organizational equipment environment. Application of microprocessors (Personal Computers, or PCs) presents interesting options. See Figure A3 for a possible system configuration.

A PC can serve as a mainframe. PC to PC communication is excellent. The central PC requires approximately a minimum 0.311 megabytes storage to handle the entire modifications data base. (See Table A3.) An IBM PC XT with 10 megabytes (32 x 0.311) is more than adequate to handle a vastly expanded data base and operating routines. Hence, a large mainframe and powerful peripheral disc drives are not required. The PC can ordinarily accept only one other device in a communications mode. However, maximum local processing would minimize central accessing, keeping it to a tolerable level. The PC cannot operate as a PC while another terminal is attached. A manually dialed

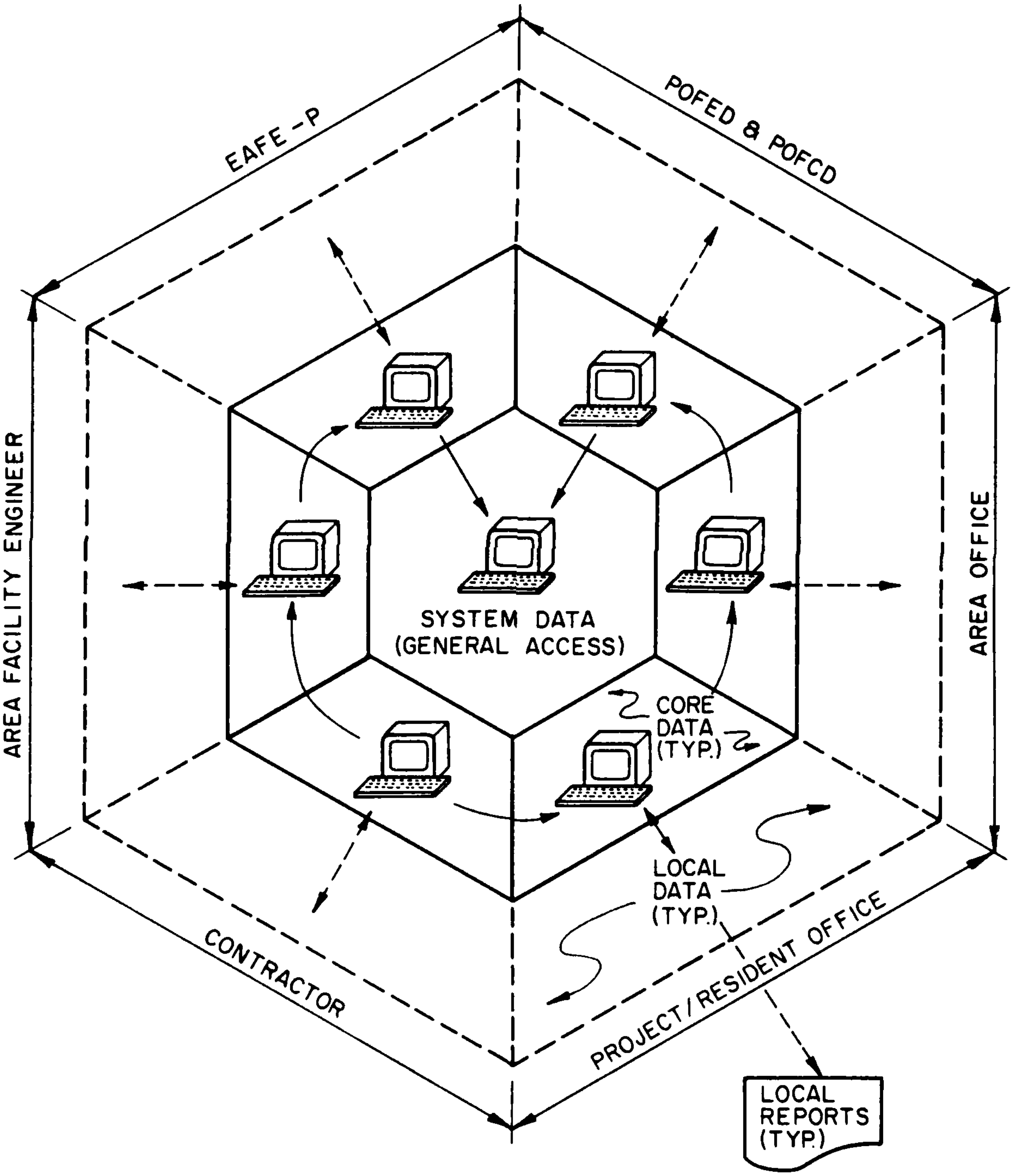

Figure A3. General hardware, communications, and data base architecture.

call is required for an unintelligent workstation to send data to or execute a program at a PC. However, communication between PCs equipped with autodial/autoanswer can be automatic.

Communications, a problem in Korea, vanishes if processing is done locally. Only project initiation data and updates to activities performed locally need be forwarded over telephone lines (or in case of line failure, forwarded by floppy disk--hand carried--a 1-1/2 hour drive at most--there are regular couriers). The majority of communications cost attributable to mainframe processing is avoided.

PC processing is not as rapid as processing on a large *dedicated* mainframe, but may be as fast or faster than on a large *shared* mainframe. Also, local processing avoids communications problems, a major source of processing frustration. Overall, local processing gives a better guarantee of reliable output.

Of course, local processor routines must be updated when the system is updated. Update can be done on-line or by floppy disc. The cost should be negligible. Perhaps a score of local workstations will eventually be affected.

Input

There are two *modification* input types (initial data entry and updates) and two input sources (FEA-K and FED). Figure A2 shows the data base to receive input.

Pre-existing	19	project values, common to all of a project's modifications
Initial Data	4	*modification* values (60 characters)
	12	activity values (19 characters)
Updates	7-25	activity completion dates (3 characters each) few extenuating causes for allowing extra time (40 characters each) few changes in estimated or transient values- Current Working Estimate Construction Contract Completion Date, Expected Project Engineers Names Contract Time Change Contract Cost Change

Updates probably will be made using current procedures, where project engineers correct a previous hard copy listing and a clerk enters the data at a computer terminal. This hard copy listing is the first report discussed in the following *Output* section, the *Project Engineer Modification Status Report.*

Centralization of data entry at EAFE-P and POFCD may be presumed, but is not functionally required. A number of interacting factors are involved in such a decision--cost, workload distribution, timeliness, data accuracy, hardware, software, and communications. However, there is a requirement that one central file exists, especially for those with comprehensive needs or a local inability to process data. Local access to standard reports is presumed.

While a project engineer has many updates to make, periodic acquisition of update information need not be formidable, since all the information should come from a half dozen or so sources, requiring one telephone call to each source.

The project engineer's task is relatively simple, making the entry or alteration of data item values, given the data item identifier. But how simple is the data entry clerk's task? Traditionally, the data entry clerk must key in both the data item identifier (name) and data item value, because update routines require the equivalent of name value pairs, the name specifying the storage location of the value. As an example, the following identifiers apply, *as a minimum*, for updating an activity completion date.

Project Identifier (12-17 characters)
- A7 Project Number
- A6 Station Code (if under AMPRS control, otherwise, A5)
- I2 Authorization Year (if under AMPRS control)
- I2 Type Funds Code (if under AMPRS control)

Modification Identifier
- I6 Modification Number

Activity Identifier
- I2 Activity Number

Activity Field Identifier
- I1 Activity Field Number

Thus, to update one activity value, a minimum of 21 identifying characters is required. Depending on the programmed data entry controls, the actual number of characters can be larger. However, all of this is not necessary to merely change one six-character activity completion date field.

One simpler approach is to update all projects for one station, all modifications for a given project at that station, all activities within a given modification and given project and given station, and all fields within a given activity. Then, after completing any data item value entry at any level, a decision must be made to stay at that level or go to some higher or lower level (if any). For example, after entering a modification field value, the next step is to decide whether to enter another same level (modification field) value, or higher level (modification or project or station identifier) value or lower level (activity identifier) value.

Another approach would be to display identifiers in the same order as Project Engineer Modification Status Report (which is marked up and in front of the data entry clerk) and allow the clerk to scroll through the identifiers and enter data opposite displayed identifiers. This approach seems least complicated. Note that Station Name, not Station Code, will be displayed as an identifier in this case.

Possibly, even simpler approaches may be found. In part, the approach adopted will be limited by available hardware and software capabilities.

Output

A variety of reports can be prepared. Four of the more important, and their significant data elements, might be:

1. <u>Project Engineer Modification Status Report</u>

Line 1, Heading; Line 2, Data.

A28	Station Name
A12	Project Engineers Names

Line 4, Heading; Line 5, Data.

A7	Project Number
A7	Facility Class and Construction Category Code
A15	Project Description
A3	Construction Agent
I6	Scope
A2	Unit of Measure (Code)
I2	Program Year
I12	Control Cost ($000)
I12	Current Working Estimate, Current ($)
A9	Construction Contract Number

Line 7, Heading; Line 8, Data.

A6	Modification Number
A40	Modification Description
I4	Contract Time Change (Days)
I10	Contract Time Change ($)
A7	Construction Contract Completion Date, Expected (DDMMMYY)

Lines 10 and 11, Heading; Lines 12 and Succeeding, Data.

I2	Activity Number
A7	Activity Completion Date, Originally Scheduled (DDMMMYY)
A7	Activity Completion Date, Actual (Past) or Estimated (DDMMMYY)
I3	Activity Time Overrun or Underrun, Days
I4	Activity Time Overrun or Underrun, Percent
I3	Activities Times Overrun or Underrun, Cumulative, Days
I4	Activities Times Overrun or Underrun, Cumulative, Percent
A40	Activity Extenuating Cause for Allowing Extra Time

The data sequence for each station is:

Station
  Project
    Modification
      Activity
      Activity
        :
    Modification
      Activity
      Activity
        :
    :
  Project
    :

2. Program Manager Modification Status Exception Report

There are two main reports: the more important report concerns modifications which cause a contract time increase, the less important being a report on modifications resulting in no time increase. The reports should be triggered by exceeding scheduled thresholds, perhaps a 50 percent time overrun for a current activity or 25 percent overrun for accumulated activities times. There should be basically one report per project, data and sorts as shown below.

Data

A28 Station Name
A3 Construction Agent
I2 Type Funds
A7 Project Number
A9 Modification Number
I2 Activity Number, Current
I3 Activity Time Overrun, Days*
I3 Activity Time Overrun, Percent*
I3 Activities Times Overrun, Cumulative, Days**
I3 Activities Times Overrun, Cumulative, Percent**
A40 Activity Extenuating Cause for Allowing Extra Time
A12 Project Engineers Names

Sort by Modification Having Greatest Impact

Contract Time Increase (descending order)
Station Name
Construction Agent
Type Funds
Project Number
Modification Number
Activity Number

Sort by Modification and Activity Having Greatest Impact (No. 1)

Contract Time Increase (descending order)
Activity Time Overrun, Percent (descending order)
Station Name
.
.
.

Sort by Modification and Activity Having Greatest Impact (No. 2)

*Blank value if current activity time threshold not exceeded.
**Blank value if cumulative activities times threshold not exceeded.

Contract Time Increase (descending order)
Activities Times Overrun, Cumulative, Percent (descending order)
Station Name

.
.
.

3. Modification Standard Time Estimates Versus Average Actual Completion Times Report

This report should be one line per activity, 34 lines total, data as follows.

I2	Activity Number
I4	Activities Measured, Number
I4	Activities Having Extenuating Causes, Number
I3	Activity Standard Time Estimate, Days
I3	Activity Actual Completion Time, Average, Days
F4.2	Activity Actual Completion Time, Standard Deviation
I3	Activity Time Overrun or Underrun, Days
I4	Activity Time Overrun or Underrun, Percent
I3	Activities Standard Times Estimate, Cumulative, Days
I3	Activities Actual Completion Times, Cumulative, Average, Days
F4.2	Activities Actual Completion Times, Cumulative, Standard Deviation
I3	Activities Times Overrun or Underrun, Cumulative, Days
I4	Activities Times Overrun or Underrun, Cumulative, Percent
A40	Activity Description

4. Modification Activity Extenuating Cause for Allowing Extra Time Report

This report has several uses. It identifies: (1) non-networked activities, their impact, and may lead to network revision, (2) the remaining small fraction of erratic, unpredictable occurrences, the causes of which may be eliminated, and (3) the remaining large fraction of common occurrences, the effects of which can be statistically measured and perhaps mitigated. The report has one section for each network activity. Each section is organized as follows. (Note that the first data line contains all Modification Standard Time Estimates Versus Average Actual Completion Times Report data, except for the five cumulative data items. Also, succeeding lines contain all Program Manager Modification Status Exception Report data, except for Activity Number.)

Lines 1 and 2, Heading; Line 3, Data.

I2	Activity Number
I4	Activities Measured, Number
I4	Activities Having Extenuating Causes, Number
I3	Activity Standard Time Estimate, Days
I3	Activity Actual Completion Time, Average, Days
F4.2	Activity Actual Completion Time, Standard Deviation
I3	Activity Time Overrun or Underrun, Days
I4	Activity Time Overrun or Underrun, Percent
A40	Activity Description

Line 5, Heading; Lines 6 and Succeeding, Data.

A28	Station Name
A3	Construction Agent
I2	Type Funds
A7	Project Number
A9	Modification Number
I3	Activity Time Overrun, Days
I3	Activity Time Overrun, Percent
I3	Activities Times Overrun, Cumulative, Percent
A40	Activity Extenuating Cause for Allowing Extra Time
A12	Project Engineers Names

Another report, the *Programs & Budget Funds Request Status Report* for the EAFE Programs & Budget Division (EAFE-R-PB), has not been designed but is related to funds requests activities (Activities 8-12). Sorts are required by Type Funds and Construction Agent and some totals are required to simplify EAFE-R-PB operations. Currently, EAFE-R-PB must manually reorganize FED Division Construction Report data to gain some of its information; this should be avoided.

Computer Programs

The simplest approach is to have all processing performed on the FED computer with the FEA-K Wang computer acting as one of the Harris terminals. Given these conditions, there are existing programs for managing AMPRS-type project and modification data elements. Additionally required supporting computer programs are:

- Activity Support File Creation and Update
- Modification Activity Network Generation
- Activity Initial Data Entry
- Activity Data Update
- Project Engineer Modification Status Report
- Program Manager Modification Status Exception Report
- Modification Standard Time Estimates Versus Average Actual Completion Times Report
- Modification Activity Extenuating Cause for Allowing Extra Time Report
- Programs & Budget Funds Request Status Report.

Of course, the alternative of partial processing at two data centers having different general-purpose programming software and lacking electronic communications, is a far more complex task. In addition to the nine above, programs are required for:

- FEA-K project and modification files management
- Reprogramming (duplication) of the first eight of the nine above-listed programs

- Updating FEA-K files with FED data

- Updating FED files with FEA-K data.

The two data centers approach has other drawbacks. Data center-to-data center transmission involves tape creation, delivery, and reading, which means duplicate documentation and duplicate training. In a region (Korea) with insufficient institutional memory to begin with, FEA-K and FED employees will not always be able to converse in common procedural terms and transfer knowledge between organizations. Unified management and purpose are difficult in themselves, but two data centers with differing capabilities would provide greater opportunities for the data centers and the customers they serve to pull in different directions.

Statistics

Tables A3 through A6 contain data storage, data entry, data output, and procedural efficiency statistics summarizing the report workload implications. Approximate figures are:

Data Storage	311	Characters/Modification
Data Entry	228	Characters/Modification
	40	Data Item Values/Modification
Data Output	1,729	Characters/Modification
	228	Data Item Values/Modification
Output/Input	7.6	Characters Output/Characters Input
	5.7	Data Item Values Output/Data Item Values Input

Relative Power of Network Generation vs. Conventional CPM

Data Storage	3.3
Data Entry	4.5
Data Output	1.0
Output/Input	4.5
Labor	3.8

Table A3

Construction Contract Modification Data Statistics—Data Storage

Item	No.	Data Elements Reqd.	Data Elements Opt.	Characters Reqd.	Characters Opt.
Projects	x	19	?	144	u
Modifications	y	6	?	75	v
Activities	z	3	1+	11	w
Support File (1 ea.)	34 (Acts.)	4	-	47	-

Data Base Size (chars.) = x(144 + u) + y(75 + v) + z(11 + w) + 34(47)

Example.

Assume.

100 Projects	x	=	100					
10 Mods/Project	y	=	100	x	10	=	1,000	
20 Activities/Mod	z	=	20	x	1000	=	20,000	
1 Support File			34	x	47	=	1,598	
0 Optional Data	u	=	v	=	w	=	0	

Data Base Size (chars.) =
100(144 + 0) + 1000(75 + 0) + 20,000(11 + 0) + 1,598 =
14,400 + 75,000 + 220,000 + 1,598 = 310,998 chars.

Characters/Modification = 310,998/1000 = 311

Table A4

Construction Contract Modification Data Statistics—Data Entry

Item	No.	Data Elements Reqd.	Data Elements Opt.	Characters Reqd.	Characters Opt.
Projects	x	19	?	144	u
Modifications	y	6	?	75	v
Activities	z	1*	1+	6	w
Initial Data/Mod	1	12	-	19	-

Data Entry Amount (chars.) = x(144 + u) + y(75 + 19 + v) + z(6 + w)

Example. (using first example assumptions)

Data Base Entry (chars.) =
100(144 + 0) + 1000(75 + 19 + 0) + 20,000(6 + 0) =
14,400 + 94,000 + 120,000 = 228,400 chars.

Characters/Modification = 228,400/1000 = 228

Data Item Values/Modification =
[100(19 + 0) + 1000(6 + 12 + 0) + 20,000(1 + 0)]/1000 = 40

*Actual completion dates only. Activity numbers can be menu-selected.

Table A5

Construction Contract Modification Data Statistics - Data Output

Item	No.	Data Elements Reqd.	Data Elements Opt.	Characters Reqd.	Characters Opt.
Projects	x	19	?	144	u
Modifications	y	6	?	75	v
Activities	z	11	1+	82*	w

Data Output Amount (chars.) = x(144 + u) + y(75 + v) + z(82 + w)

Example. (using first example assumptions)

Data Base Output (chars.) =
100(144 + 0) + 1000(75 + 0) + 20,000(82 + 0)
14,400 + 75,000 + 1,640,000 = 1,729,400 chars.

Characters/Modification = 1,729,400/1000 = 1729

Data Item Values/Modification =
[100 (19 + 0) + 1000(6 + 0) + 20,000(11 + 0)]/1000 = 228

Output/Input = 1729/228** = 7.6 characters out/characters in

Output/Input = 228/40** = 5.7 data item values out/data item values in

*Activities Data Elements

Format	Data Element Name
I2	Activity Number
I6	Activity Completion Data, Actual
I3	Activity Estimated Completion Time, Cumulative
(A40)	Activity Extenuating Cause for Allowing Extra Time (Optional)
I3	Activity Standard Time Estimate
A40	Activity Description
A7	Activity Completion Date, Originally Scheduled (DDMMMYY)
A7	Activity Completion Date, Actual (Past) or Estimated (DDMMMYY)
I3	Activity Time Overrun or Underrun, Days
I4	Activity Time Overrun or Underrun, Percent
I3	Activities Times Overrun or Underrun, Cumulative, Days
I4	Activities Times Overrun or Underrun, Cumulative, Percent
82	Total (excluding A40, Activity Extenuating Cause for Allowing Extra Time [Optional])

** See Table A4 for input (entry) values.

Table A6

Conventional Versus Generated Activity Network Data Statistics Comparison

Topic / Item	Conventional (CPM)	Network Generation	Conventional/ Generation
Given			
Projects	100	100	
Modifications	1,000	1,000	
Activities	20,000	20,000	
Data Entry			
Characters/Project	144	144	1.0
Characters/Modification	75	75	.01
Characters/Activity	47	6	7.8
Mod. Network Initiation	-	19	-
Data Entry (Characters)			
Projects	14,400	14,400	1.0
Modifications	75,000	75,000	1.0
Activities	940,000	120,000	7.8
Network Initiation	-	19,000	-
Total	1,029,400	228,400	4.5
Data Storage (Characters)	1,029,400	310,998*	3.3
Data Input/Output (Chars.)			
Input	1,029,400	228,400	4.5
Output	1,729,400**	1,729,400**	1.0
Input/Output	.595	.132	4.5
Labor (Hours)			
Preparation, Professional	500	83	6.0
Data Entry, Clerical	200+	100+	2.0
Total	700+	183+	3.8

*See Table A3.
**See Table A5.

APPENDIX B:

AIR FORCE (USING AGENCY) CHANGE REQUESTS

```
              ****************************
ROUTINE       * U N C L A S S I F I E D *
              ****************************
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RCTUZOVW RUHVAAB0273 1792353-UUUU--RUAGEDE.
RCTUZYUW RUHVAAB0273 1792353-UUUU--RUAGAAA.
ZNR UUUUU
R 271922Z JUN 84
FM HQ PACAF HICKAM AFB HI//DEE//
TO RHMDULA/3CSG CLARK AB RP//DEE//
RUAKMLA/8CSG KUNSAN AB KOREA//DEE//
RHAKAAA/18CSG KADENA AB JA//DEE//
RUDUAAH/51CSG OSAN AB KOREA//DEE//
RUADJHA/475ABW YOKOTA AB JA//DEE//
RUKUAAA/6112ABW MISAWA AB JA//DEE//
ZEN 15ABW HICKAM AFB HI//DEE//
INFO RUADJHA/5AF YOKOTA AB JA//DE//
RUDUAAH/HQ 314AD OSAN AB KOREA//DE//
RUAGAAA/DET 1 314AD YONG SAN RESERVATION AIN KOREA//DEX//
RUAKRSA/6168CSS TAEGU AB KOREA//DE//
RUAKLSA/6171ABS KWANGJU AB KOREA//DE//
RUAKBRA/6170CSS SUWON AB KOREA//DE//
RUHHHHA/DIVENGR USAEDPO FT SHAFTER HI//PODCO E//
RUADJHA/DISTENGR JAPAN CP ZAMA JAPAN//POJCD E//
RUAGAAA/DISTENGRFE SEOUL KOREA//POFCD O//
RUADBEA/AREA ENGR OKINAWA MAKIMINATO JA//POJOA//
RHHMBRA/PACNAVFACENGCOM PEARL HARBOR HI//CODE 09A//


PAGE 02 RUHVAAB0273  UNCLAS
RUMFOIC/OICCSOWESTPAC MANILA RP
BT
UNCLAS
SUBJ:  AIR FORCE (USING AGENCY) CHANGE REQUESTS
1.  WE HAVE BEEN EXPERIENCING VARIOUS PROBLEMS IN PROCESSING USING
AGENCY REQUESTS FOR CONSTRUCTION CHANGES.  IN OUR EXPERIENCE, WE
FOUND THAT MANY OF THESE CHANGES SHOULD HAVE BEEN ADDRESSED WHEN
THE PROJECT WAS BEING DESIGNED AND REVIEWED; HOWEVER, MANY FELL
THROUGH THE CRACK.  SOMETIMES THE USING AGENCY TRIES TO GET
ADDITIONAL FEATURES INSERTED INTO THE CONTRACT BY CONSTRUCTION
CHANGE WHEN THEY REALIZE THAT THE PROJECT WAS AWARDED BELOW THE
PROGRAMMED AMOUNT.  BUT THE MOST SIGNIFICANT PROBLEM IS THAT IT
TAKES TOO MUCH TIME TO HAVE A REQUEST REVIEWED, APPROVED AND
IMPLEMENTED.
```

ROUTINE ****************************
* U N C L A S S I F I E D *
****

2. A CHAANGE REQUEST CREATES AN ADDITIONAL WORKLOAD AT ALL LEVELS; THE USING AGENCY, THE BCE, HQ PACAF, HQ USAF, THE DESIGN/ CONSTRUCTION AGENT AND ULTIMATELY THE CONTRACTOR. IT TAKES EVERYONE'S TIME, COMPLICATES THE CONSTRUCTION PROGRESS, INCREASES THE COST OF THE PROJECT AND DELAYS THE BENEFICIAL OCCUPANCY DATE (BOD) OF THE FACILITY.

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3. IN ORDER THAT EVERYONE U DERSTAND THE COMPLEXITY OF THESE CHANGE REQUESTS, WE HAVE OUTLINED THE PROCESS AND SOME OF ITS ASSOCIATED PROBLEMS BELOW.

A. BASE CIVIL ENGINEER

(1) WHEN THE CHANGE REQUEST IS SUBMITTED TO YOU, TAKE A GOOD LOOK AT IT; IS THE PROPOSED CHANGE WITHIN THE PROJECT SCOPE, DOES IT AFFECT THE FUNCTIONAL USE OF THE FACILITY, IS IT ESSENTIAL, IS IT PROPERLY JUSTIFIED? (SEE AFR 89-1, PARA 12-21(3)).

(2) WHEN THE USING AGENCY MERELY CITES THE PARAGRAPH OF AN AIR FORCE REGULATION, IT IS NOT SUFFICIENT JUSTIFICATION. SEND IT BACK FOR REJUSTIFICATION. THE JUSTIFICATION MUST EXPLAIN WHY THE PROPOSED CHANGE IS RECESSARY AND WHAT WOULD HAPPEN IF IT WAS NOT APPROVED. ADDITIONALLY, IT IS HQ USAF'S POLICY TO APPROVE CHANGES UP TO THE 50 PCT CONSTRUCTION STAGE. CHNG REQUESTS AFTER THIS POINT WILL BE DISAPPROVED UNLESS IT IS ABSOLUTELY ESSENTIAL.

(3) IF THE PROPOSED CHANGE DOES NOT MEET THE ABOVE CRITERIA, YOU HAVE THE AUTHORITY TO REJECT THE REQUEST.

(4) IF THE REQUEST IS VALID, PREPARE A PACKAGE FOR SUBMITTAL TO HQ PACAF. THE PACKAGE MUST INCLUDE A COST ESTIMATE AND DESCRIPTION OF EACH INDIVIDUAL CHANGE, REFERENCE TO THE SHT NUMBER OF THE CON-

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TRACT DRWGS, A SKETCH OF THE PROPOSED CHANGE AS APPROPRIATE AND THE PROPER JUSTIFICATION.

B. HQ PACAF (MAJCOM/AFRCE)

(1) WE WILL REVIEW YOUR SUBMITTAL FROM THE VIEWPOINT OF BOTH THE AIR FORCE AND THE CONTRACTOR AND MAKE AN EVALUATION BASED ON THE POTENTIAL IMPACT OF THE CHANGE.

(2) IF THE REQUEST IS VALLID IN ALL RESPECTS, WE WILL APPROVE THE CHANGE REQUEST PROVIDED THERE ARE SUFFICIENT FUNDS IN OUR AFRCE MANAGEMENT RESERVE. IF THERE ARE INSUFFICIENT FUNDS, WE WILL PROCESS A REQUEST TO HQ USAF FOR APPROVAL AND ADDITIONAL FUNDS.

(3) ONCE THE CHANGE REQUEST IS APPROVED, WE WILL ADVISE THE DESIGN/CONSTRUCTION AGENT (CORPS OF ENGINEERS OR THE NAVY OICC) TO PROCEED WITH THE CHANGE. A COPY OF THE CORRESPONDENCE WILL BE FORWARDED TO YOUR OFFICE TO KEEP YOU APPRISED OF THE SITUATION.

ROUTINE •••••••••••••••••••••••••••
• U N C L A S S I F I E D •
•••••••••••••••••••••••••••

C. HQ USAF
(1) WHEN REQUIRED THEY WILL EVALUATE OUR REQUEST FOR ADDITIONAL FUNDS AND APPROVE/DISAPPROVE IT.
(2) MANY OF OUR REQUESTS ARE DETAINED AT HQ USAF BECAUSE THEY FREQUENTLY ASK FOR MORE INFORMATION. THIS GENERALLY MEANS THAT THE REQUEST WAS NOT ADEQUATELY DESCRIBED OR JUSTIFIED.

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D. DESIGN/CONSTRUCTION AGENT
(1) UPON RECEIPT OF THE APPROVED CHANGE, THEY WILL REVISE THE DESIGN AS NECESSARY, AND NEGOTIATE THE CHANGE WITH THE CONSTRUCTION CONTRACTOR.
(2) AFTER THE NEGOTIATION, WE SOMETIMES HAVE TO GO BACK TO HQ USAF FOR ADDITIONAL FUNDS.
E. CONSTRUCTION CONTRACTOR
(1) AFTER THE NEGOSIATION IS SETTLED, THE CONTRACTOR WILL ORDER THE NECESSARY MATERIALS AND IMPLEMENT THE CHANGE ORDER.
4. AS YOU CAN SEE, THE PROCESS IS QUITE INVOLVED AND TAKES A LOT OF TIME. IN THIS MSG WE HAVE TRIED TO CLARIFY THE RESPONSIBILITY OF OUR ROLES IN HANDLING CONSTRUCTION CHANGES AND TO POINT OUT SOME OF THE PROBLEM AREAS. OUR GOAL IS TO COMPLETE CONSTRUCTION WITHIN THE CWE ESTABLISHED AT THE TIME OF THE CONTRACT AWARD. BASICALLY, THIS MEANS NO CHANGES AT ALL.
5. HOWEVER, WE REALIZE THIS IS NOT ALWAYS POSSIBLE. IT THEN BECOMES EVERYONE'S RESPONSIBILITY TO MINIMIZE COST GROWTH OF MCP PROJECTS DURING CONSTRUCTION. THIS CAN BE DONE BY MAKING A DISCRIMINATING EVALUATION OF THE CHANGE REQUEST. IF THE CHANGE IS NECESSARY, PREPARATION OF A GOOD SUBMITTAL PACKAGE AT THE OUTSET

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WILL HELP IN OUR EVALUATION. WE SOLICIT YOUR COOPERATION IN THIS MATTER TO SPEED UP THE PROCESS.
6. REQUEST YOUR STAFF REVIEW THE CONTENTS OF THIS MSG SO THEY WILL BE FAMILIAR IN PROCESSING CHANGE REQUESTS. NOTE THAT WE HAVE ADDRESSED ONLY THE AIR FORCE (USING AGENCY) CHANGE REQUESTS AND NOT THE CONSTRUCTION AGENCY CHANGES NOR THE CONSTRUCTION AGENCY CHANGE REQUESTS. ALL OF THESE ARE FURTHER COVERED IN AFR 89-1, CHAPTER 12.
7. PLEASE RETAIN THIS MSG FOR FUTURE REFERENCE.
BT
#0273

ABBREVIATIONS

AE	Architect-Engineer
AFE	Area Facilities Engineer
AJ	Assistant Chief of Staff, EUSA
AMPRS	Automated Military Progress Reporting System
AR	Army Regulation
BMAR	Backlog of Maintenance and Repair
CAPCES	Construction Appropriations, Programming, Control, and Execution System
CDR	Commander
CE	Corps of Engineers
CONUS	Continental United States
CY	Current Year
DA	Department of the Army
DAC	Department of the Army, Civilian
DAR	Defense Acquisition Regulation (formerly, the ASPR)
DCAA	Defense Contract Audit Agency
DCC	Direct Construction Costs
DEH	Directorate of Engineering and Housing
DF	Disposition Form
EAFE	U.S. Army Facilities Engineer Activity, Korea
EAFE-P	U.S. Army Facilities Engineer Activity, Korea Directorate of Plans, Programs, and Project Management
EAFE-R-PB	U.S. Army Facilities Engineer Activity, Korea Program and Budget Division
EAKC	U.S. Army Korea Contracting Agency
EAST-FAO	U.S. Army Korea Finance and Accounting Office
ENJ	Eighth United States Army Engineer
ER	Engineer Regulation
EUSA	Eighth United States Army
F&A	Finance and Accounting
FEA-K	Facilities Engineer Activity - Korea
FED	Far East District
FS	Facilities Systems Division
FY	Fiscal Year
GS	Government service
HQDA	Headquarters, Department of the Army
HQ FEA-K	Headquarters, Facilities Engineer Activity - Korea
KATUSA	Korean Augment to the United States Army
KCA	Korean Contracting Agency
MACOM	Major Command
MCA	Military Construction, Army
MSC	Major Subordinate Command
OACE	Office of the Assistant Chief of Engineers
OCE	Office of the Chief of Engineers
OEB	Office Engineering Branch
OMA	Operations and Maintenance, Army
PAX	Programming, Administration and Execution System
P^3M	Plans, Programs, and Project Management Directorate
POD	U.S. Army Engineer Division, Pacific Ocean
PODCC-M	U.S. Army Engineer Division, Pacific Ocean Management Analysis Branch
POF	U.S. Army Engineer District, Far East

POFCD-O	U.S. Army Engineer District, Far East, Construction Division Office Engineering Branch
POFED	U.S. Army Engineer District, Far East, Engineering Division
POFOC	U.S. Army Engineer District, Far East, Office of Counsel
POFSP	U.S. Army Engineer District, Far East, Procurement and Supply Division
PY	Prior Year
RAMP	Responsiveness Analysis of Military Programs
RFQ	Request for Quotation
S&A	Supervision and Administration
S&I	Supervision and Inspection
SOP	Standard Operating Procedure
U.S.	United States
USACC	U.S. Army Communications Command
USA-CERL	U.S. Army Construction Engineering Research Laboratory
USA-CERL-FS	U.S. Army Construction Engineering Research Laboratory Facility Systems Division

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